

ORIGINAL PAPER

Infectious Diseases

Prevalence and predictors of self-medication drugs to prevent or treat COVID-19: Experience from a Middle Eastern country

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Abstract

Background: The lack of definitive cure for COVID-19 and the late introduction of a vaccine were responsible to push the general public to look for a remedy to treat or prevent COVID-19. The objective of this study was to evaluate patterns and factors that affect self-medication practices in Jordan during the pandemic.

Methods: This was a cross-sectional study using an online questionnaire that was developed, piloted and distributed to the general public via various social media platforms. The questionnaire assessed the type of drugs and treatments used to self-medicate, the reasons behind their self-medication, and the factors affecting their practices.

Results: A total of 1179 participants (females 46.4%) with a mean age of 32 (SD = 12.5) completed the questionnaire. The overall prevalence of the use of at least one product to treat or prevent COVID-19 was 80.4%. The most commonly used products to self-medicate were vitamin C (57.6%), followed by paracetamol (51.9%), zinc (44.8%) and vitamin D (32.5%). Female gender (odds ratio [OR]) = 1.603, working in the medical field (OR = 1.697), and history of COVID-19 infection (OR = 2.026) were variables associated with self-medication. The most common sources of participants' information about drugs to prevent or treat COVID-19 were newspapers (n = 519, 44.0%), followed by pharmacists (43.4%), friends (33.8%) and internet searching such as Google (30.7%).

Conclusion: This study identified the main drugs and supplements used during COVID-19 and the motives behind their use. It also identified the most influential source of information on the public during the pandemic. Self-medication can lead to worsening of the patient's health and delay seeking medical advice from healthcare professionals. Efforts should be done to help mitigate risks of self-medications by active involvement of pharmacists and other members of healthcare team to refute false claims about drug, especially in the media.

1 | INTRODUCTION

By the end of 2019, an outbreak of severe viral respiratory infection was reported in China, which later spread to all parts of the world.¹ In March 2020, the World Health Organization (WHO) declared the infection as a pandemic. Later, the causative agent was identified as

severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the disease was named Coronavirus disease-19 (COVID-19).¹ This pandemic is the first major pandemic in the 21st century, which in about one and a half year from its reporting in China, affected more than 172 million people around the world and claimed the lives of more than 3.7 million people.² The disease varies in its symptoms

that range from asymptomatic to severe life-threatening ones. The mild symptoms include coughing, sore throat, fatigue, fever and the severe symptoms include difficulty breathing, chest pain and confusion.³ Patients suffering from severe symptoms or with deteriorating conditions required hospitalization, some needed intensive care and others could not survive. A major proportion of the patients hospitalized presented with hypoxia, respiratory acidosis, opacity/infiltrate on imaging and high inflammatory markers.⁴

Up to this date (June 2021), no definitive treatment or cure is known, although several treatment protocols were proposed and used by different countries or hospitals. In addition, no vaccine was available until recently, where the first listed vaccine for WHO emergency use authorization was given on 31 December 2020 to Pfizer/BioNtech followed by other vaccines from other companies later on.⁵

Under these circumstances, the general public was seeking information from all sources, local and international, to look for a remedy to treat or prevent contracting the disease.⁵ At the same time, different media focused on some treatments and drugs suggested by some reports or health authorities around the world to treat or prevent COVID-19. Among these drugs were hydroxychloroquine, azithromycin and other antibiotics, NSAID, vitamins and others.^{6,7} This information was circulated among the public and led to stocking or using these drugs by the general population.^{6,7} As a consequence, self-medication was boosted during the pandemic in many parts of the world. This can be seen by observing the trend in the worldwide web search for the keywords such as "self-medication", "self-care", "self-administration" where such terms showed a relative increase in Google hits during the pandemic.⁸ In fact due to the huge pressure imposed on the health care system in many countries as a result of the pandemic, many health authorities including the WHO, published instructions to the general public on how to manage mild to moderately sick patients with COVID-19 at home.^{9,10} However, using drugs without medical supervision is a harmful practice, since it may lead to serious drug interactions, adverse drug effects, masking severe illness, antimicrobial resistance, and risk of dependence and abuse.^{11,12} This has led the WHO to ask the people to be cautious when using certain drugs or home remedies to treat COVID-19, and it also placed some drugs believed by the general public to cure from COVID-19 within a "Mythbusters" webpage to refute this claim.¹³

Jordan, a Middle Eastern country with population of 10 million, reported the first case of COVID-19 in March 2020. Within 15 months the pandemic caused more than 700,000 morbidity and more than 9500 death cases.¹⁴ Before the pandemic, self-medication was reported among Jordanians who use different classes of drugs and dosage forms, with prescription or without prescription.¹⁵⁻¹⁷ As other nations, Jordanians are expected to interact with the news and updates associated with the pandemic in terms of suggested treatments or remedies and to take actions to treat or protect themselves.

Consequently, the aim of this study was to evaluate the type of drugs and treatments used by Jordanians to self-medicate/self-care during the pandemic, the reasons behind their self-medication, the sources of information and the factors affecting their practices.

What's known

- Self-medication practices are common worldwide.
- The use of self-medications was aggravated during COVID-19 pandemic.

What's new

- This study is the first in Jordan and the second in the Middle East to describe self-medication practices during COVID-19.
- It identified the main drugs and supplements used during COVID-19 and the motives behind their use, and also it identified the most influential source of information on the public during the pandemic.
- Pharmacists are important source of information about self-medication drugs used to prevent or treat COVID-19; thus, their role in provision of safe and effective drug use should be implemented more effectively.

Knowing these attributes can help the policy makers during epidemics and pandemics, to understand the motives of the public towards the use of different drugs, the factors affecting their behaviors and the most influential source of information on the public.

2 | METHODS

2.1 | Study design and participants

This was a cross-sectional study conducted during the COVID-19 pandemic over the period from 26 March to 16 April 2021. The study targeted adult resident Jordanians. It was a questionnaire based and self-selection study.

Using Google Forms, which is a cloud-based survey tool (ie, survey administration software) powered by Google™, a structured questionnaire was created for data collection. The questionnaire link was then distributed on various social media platforms, including Facebook®, Facebook Messenger® and WhatsApp Messenger®. Social media platforms were chosen to distribute the questionnaire link as Jordanians are very active on social media platforms which enabled the research team to collect data in a cost-effective and time-efficient way. In addition, this method of data collection deemed necessary to decrease the need of direct contact with participants under the pandemic situation. Furthermore, there is no official database that can be utilized by the researchers to reach Jordanian people (like a defined list of e-mails or so), making social media platforms the only feasible way in reaching Jordanian people in a time-efficient way by eliminating geographical boundaries.

Snow ball sampling technique was used to distribute the Google form and enrol participants.^{18,19} This method includes sending the link of the Google form to the contact lists of the authors, in addition

to neighbours, friends, relatives, coworkers of all levels and departments, friends of friends, different WhatsApp and Facebook groups and encouraging participants to further share the link with their relatives, friends, colleagues and their broader social network.

Inclusion criteria for participation included: (a) age ≥ 18 years, (b) residing in Jordan during the pandemic and its confinement measures and (c) providing consent to participate in the study. To make sure that participants fulfilled the inclusion criteria, two questions were added at the beginning of the survey ('Are you an adult whose age is 18 years or older?' and 'Do you agree to participate in the study?'). Answering 'No' to any of these questions prevented the participants from completing the survey.

2.2 | Study instrument

Extensive literature review was performed and the structure of the questionnaire was developed based on published research.^{6,7,20,21} In addition, the list of self-medication drugs was developed based on a pilot study conducted on pharmacists working in community pharmacies during COVID-19 pandemic. Pharmacists were asked to report drugs, drug groups, supplements and minerals for which they noticed an increase in their demand during COVID-19 pandemic. A total of 10 pharmacists had responded and a final list of self-medication drugs was refined after considering repeated answers.

The questionnaire content was translated from English into Arabic and then critically revised and face-validated by several academic colleagues. The questionnaire was amended based on the notes and comments received after piloting to a sample of 50 adults.

The final version of the questionnaire consisted of three main sections. The first section included demographic and general characteristics of the participants such as gender, age, education, income, employment, general health, history of self or a close relative COVID-19 infection, and residential area. The second section assessed participants' self-medication practices during COVID-19 pandemic. The first question in this section was "Have you used any medicine without consulting a physician or without having a prescription to prevent or treat COVID-19 symptoms".

Following this question, participants were provided a list of self-medication drugs including prescription only medicines (POMs), over the counter medications (OTC), minerals and supplements. The participants were asked to answer if they used any drug, supplement or mineral from the list provided and the reason for its use. Possible reasons for the use of self-medication drugs included (a) treating symptoms such as fever, muscle pain, and sore throat, (b) being in contact with an infected person, (c) having a positive coronavirus test, (d) preventing COVID-19 infection despite having no symptoms, (e) consuming this drug regularly for reasons other than COVID-19 and (f) never used this medication.

The list included the following: (a) antibiotics including azithromycin and doxycycline, (b) analgesics and antipyretics including paracetamol, ibuprofen and diclofenac, (c) minerals including zinc, magnesium, and iron salts, (d) vitamins including vitamins C, D and

B and multivitamins, (e) herbals and supplements including propolis, omega 3 fatty acids and immune boosting supplements, (f) antithrombotic drugs including aspirin and enoxaparin, (g) cold and cough preparations, (h) antihistamines and (i) others including antiseptic lozenges, nasal solutions containing normal saline or sea water, clove oil and menthol rub. Brand names of specific antibiotics and analgesics were provided in the list to facilitate their recognition by participants.

The third section addressed participants' sources of information about self-medication drugs used to prevent or treat COVID-19.

2.3 | Study sample size

A minimum sample of 1050 adults aged 18 and older was estimated based on the following Equation²²: $N = \frac{PQ(Z_{\alpha} + Z_b)^2}{d^2}$, where N is the sample size, Z_{α} : type one error = 1.96 when $\alpha = 5\%$; $Q = 1 - P$: expected non-prevalence; P = proportion in the population possessing the characteristic of interest, d = one-half of the desired interval of confidence, in this study $d = 5\%$.

Accordingly, by filling in the equation, $N = 0.5 \times 0.5 (1.96 + 1.28)^2 / 0.0025 = 1049.76$.

2.4 | Statistical analysis

Statistical analysis was performed using SPSS version 20.0 (SPSS Inc, Chicago, IL). Descriptive statistics were used to describe demographic characteristics of participants. Categorical variables were presented as percentages with frequencies, while continuous variables were presented as mean with standard deviation (SD).

Associations between self-medication practices and categorical variables including demographic and general characteristics were performed using Chi-square test.

The outcome variable, self-medication practices, was related to any of the previous categorical variables. All variables found to have a significant association ($P < .05$) with self-medication practices (univariate analysis) were entered into a binary logistic regression analysis to assess the association between variables of interest and the outcome.

2.5 | Ethical consideration

The study protocol was approved by the Institutional Review Board at the Deanship of Academic Research at the University of Jordan (IRB No. 27/2021). In addition, this study was conducted in compliance with the Declaration of Helsinki. The first page of the Google form included information about the nature and aims of the study as well as inclusion criteria for participation. Participants were assured that their participation is voluntary, their responses will be confidential, used for research purposes only and their identity will not be known to researchers.

3 | RESULTS

3.1 | Sociodemographic characteristics of participants

A total of 1179 participants completed the questionnaire. The mean age (years) of the respondents was 32.0 ± 12.5 . Females accounted for less than half of the participants ($n = 665$, 46.4%). Almost 60% of the respondents had a university level of education or higher ($n = 707$). About half of the participants were either full time or part time employed or have their own business ($n = 578$, 49.1%). More than one third of the participants had their study in the medical field ($n = 467$, 36.6%), but only one fifth of them work in the medical field ($n = 236$, 20.0%). More than two thirds of participants had a job that requires physical interaction with the public ($n = 433$, 75.8%). The majority of respondents rated their general health as very good or good ($n = 1039$, 88.2%). One half of participants were not infected with COVID-19, while 34.8% of them have positive results for coronavirus infection ($n = 410$) and 15.1% ($n = 178$) were not sure if they were infected or not. On the other hand, more than two thirds of participants ($n = 821$, 69.6%) had a close family member infected with COVID-19.

More than half of participants were from Amman, the capital city of Jordan ($n = 683$, 57.9%). The remaining were from north of Jordan ($n = 267$, 22.6%), middle ($n = 174$, 14.8) and south of Jordan ($n = 55$, 4.7%). Full sociodemographic characteristics of participants are illustrated in Table 1.

3.2 | Self-medication practices during COVID-19 pandemic

The overall prevalence of the use of at least one product to treat or prevent COVID-19 was 80.4%. Figures 1 and 2 describes in detail the percentage of participants using different numbers of drugs to self-medicate. The most commonly used products to self-medicate were vitamin C (57.6%, $n = 679$), followed by paracetamol (51.9%, $n = 611$), zinc (44.8%, $n = 529$) and vitamin D (32.5%, $n = 384$).

Paracetamol was the main product used to treat symptoms such as fever, muscle pain, and sore throat (36.0%, $n = 424$), followed by cold and /or cough preparations or mucolytics (21.1% $n = 249$), anti-septic lozenges, eg, Strepsils[®], Halls[®], Ricola[®] (17.2%, $n = 203$), anti-histamines (13.9%, $n = 164$) and ibuprofen (13.4%, $n = 158$).

Vitamin C (20.7%, $n = 244$ vs 17.6%, $n = 208$) and zinc (15.8%, $n = 186$ vs 15.4%, $n = 181$) were the most commonly used products to prevent and treat COVID-19 infection, respectively. Details of various products used for self-medication and the reasons of their use are presented in Table 2.

In addition to the drug list in Table 2, participants were asked if they started to take antidepressants and anxiolytics. A total of 41 (3.4%) and 49 (4.1%) participants started to take an antidepressant or an anxiolytic during COVID-19 pandemic respectively. Moreover, participants were asked if they purchased other items like

TABLE 1 Demographic and general characteristics of participants ($n = 1179$)

Variables	% (n)
Age [mean \pm SD]	32.0 \pm 12.5
Age group (y)	
18-25	43.2 (505)
26-35	22.8 (267)
36-45	18.7 (219)
46-55	9.5 (111)
>55	5.7 (67)
Gender	
Male	43.6 (514)
Female	56.4 (665)
Marital status	
Married	42.9 (506)
Single	53.4 (629)
Others	3.7 (44)
Educational level	
Post graduate	13.4 (158)
University level	46.6 (549)
Diploma	17.0 (201)
12 y	14.6 (172)
Less than 12 y	8.4 (99)
Income (per individual)	
750 JD or less	64.9 (765)
More than 750 JD	35.1 (414)
Employment status	
Working, full time	34.9 (411)
Working, part time	7.4 (87)
I have my own business	6.8 (80)
Student	24.3 (286)
Retired	4.4 (52)
Housewife	12.3 (145)
Not working	10.0 (118)
Education in the health or medical field	
Yes	39.6 (467)
No	60.4 (712)
Work in the medical field (yes)	20.0 (236)
If you are working, does your job require physical interaction with the public? Eg, banking, education, transportation, healthcare sectors	
Yes	75.8 (433)
No	24.2 (138)
How many children (under 18 y of age) live in your household	
None	36.7 (433)
1	19.6 (231)
2	19.1 (225)

(Continues)

TABLE 1 (Continued)

Variables	% (n)
3	15.0 (177)
4 or more	9.6 (113)
How many individuals (including you) live in your household	
1	2.4 (28)
2	5.9 (70)
3	9.7 (114)
4	17.0 (200)
5	21.5 (254)
6	19.8 (233)
7 or more	23.7 (280)
How do you assess your health?	
Very good	59.4 (700)
Good	28.8 (339)
Moderate	10.3 (122)
Poor	1.1 (13)
Very poor	0.4 (5)
Have you been infected with coronavirus?	
Yes	34.8 (410)
No	50.1 (591)
Not sure	15.1 (178)
To your knowledge, has any of your close family been infected with corona virus	
Yes	69.6 (821)
No	30.4 (358)
Where do you live	
Amman	57.9 (683)
North of Jordan	22.6 (267)
South of Jordan	4.7 (55)
Middle of Jordan	14.8 (174)

hand sanitizer, thermometers, or oximeters during COVID-19. Hand sanitizer was the most commonly purchased item (74.0%, $n = 872$), followed by thermometers (30.4%, $n = 358$), and oximeters (20.9%, $n = 246$). Surprisingly, 199 participants (16.9%) have not purchased any of the previous items during COVID-19 infection, Table 3.

3.3 | Factors affecting self-medication practices during COVID-19 pandemic

Table 4 shows the associations between the practice of self-medication and different sociodemographic and general characteristics of participants. Bivariate analysis revealed that age, gender, marital status, work in the medical field, being infected with coronavirus, having any close family member infected with coronavirus, were significantly associated with self-medication practices during COVID-19 pandemic. Self-medication practices were more common among females compared to males (84.7% vs 74.9%, P value

$<.005$), participants working in the medical field (86.4% vs 78.9%, P value .010), participants infected with coronavirus (93.4% vs 69.7%, P value $<.005$), participants having a family member infected with corona virus (83.7% vs 72.9%, P value $<.005$). In contrast, self-medication practices were less common among single participants (76.3% vs 85.2% [married], 84.1% [others]).

All variables shown in Table 4 that were found to have a significant association with self-medication practices during COVID-19 pandemic (bivariate analysis) and were entered into a logistic regression model. Among the participants who reported self-medication practices during COVID-19 pandemic, the odds ratios were significantly higher for: females (odds ratio [OR] = 1.603, confidence interval [CI]: 1.175-2.183, P value = .003), participants working in the medical field (OR = 1.697, CI: 1.105-2.605, P value = .016), and participants with history of COVID-19 infection (OR = 2.026, CI:1.111-3.693, P value $<.005$).

A test of the final model Hosmer and Lemeshow test for goodness of fit, $\chi^2 = 4.477$, $P = .812$, showed that the model was statistically reliable.

3.4 | Sources of information about self-medication drugs used to prevent or treat COVID-19

The most common sources of participants' information about drugs to treat or prevent COVID-19 were newspapers ($n = 519$, 44.0%), followed by pharmacists ($n = 512$, 43.4%), friends ($n = 399$, 33.8%) and internet searching such as Google ($n = 362$, 30.7%). Other sources are shown in Table 5.

A significantly higher percentage of self-medication use was associated with using the following information sources about self-medication drugs to prevent or treat COVID-19: physician clinic (84.2% vs 79.0%, P -value .046), friends (85.0% vs 78.1%, P -value .005), pharmacists (85.9% vs 76.2, P -value $<.005$) and ministry of health help centre (86.8% vs 79.6%, P -value .047),

On the other hand, using newspapers (75.1% vs 84.5%, P -value $<.005$) and internet search through Google (76.8% vs 82.0%, P -value .038) as sources of information were associated with lower percentage of participants using self-medication drugs to prevent or treat COVID-19, (All P values were calculated using Pearson Chi-Square test).

4 | DISCUSSION

This study is the first in Jordan and the second in the Middle East to describe self-medication practices during COVID-19. It identified the main drugs and supplements used during COVID-19 and the motives behind their use. It also identified the most influential source of information on the public during the pandemic. Pharmacists were important source of information about self-medication drugs used to prevent or treat COVID-19, thus, their role in provision of safe and effective drug use should be implemented more effectively.

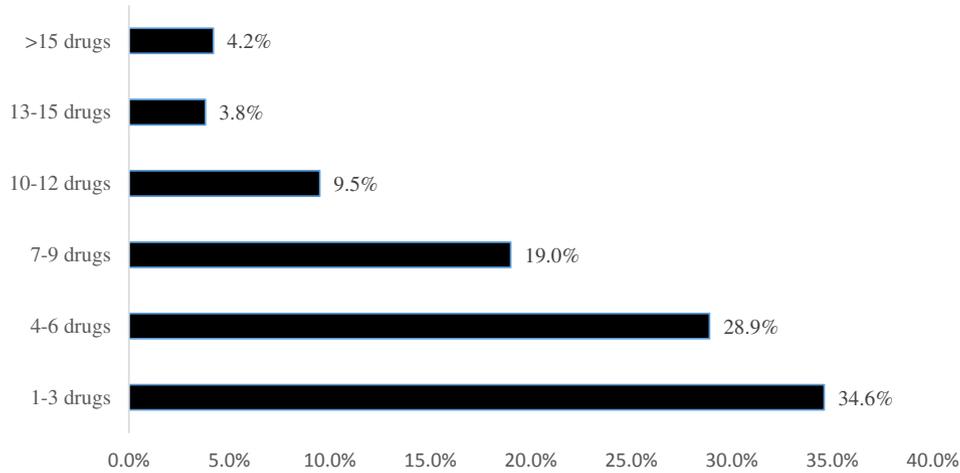


FIGURE 1 Percentage of participants using different numbers of self-medication drugs

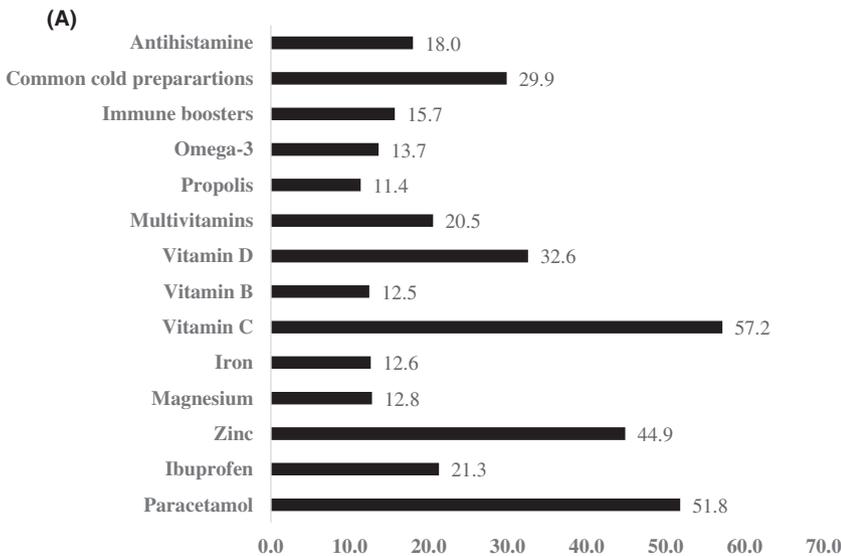
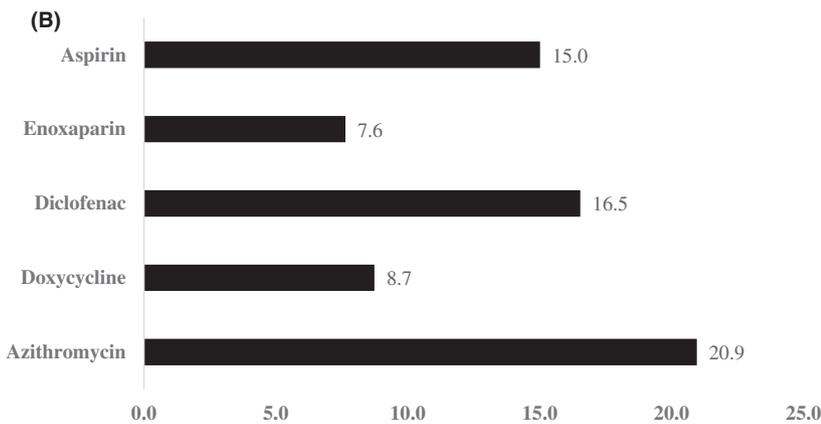


FIGURE 2 A, Percentage of participants using OTC self-medication during COVID-19. B, Percentage of participants using Prescription only medicines for self-medication during COVID-19



Since the world was hit by the same pandemic, the people worldwide lived under similar conditions of lockdowns, increased morbidity and mortality, and fearing for their lives and their loved ones. Therefore, we believe that the outcomes of this study can be extrapolated to many other countries in the world.

Self-medication is a common practice in Jordan and other countries.^{6,7,23} It is unsurprising, therefore, that during crisis times like the current COVID-19 pandemic for this behavior to be aggravated, especially in a country with limited resources such as Jordan.²⁴ Social media could have contributed as well to the spread of a huge amount

TABLE 2 Self-medication drugs among participants during COVID-19 (n = 1179)

Drugs	% (n)					
	Never used this medication	To treat symptoms such as fever, muscle pain, and sore throat	I have been in contact with a coronavirus positive person	Because of my positive coronavirus test result	I did not have specific symptoms but used them to prevent coronavirus infection	Consume it regularly for reasons other than COVID-19
Antibiotics						
Azithromycin	76.9 (907)	9.1 (107)	1.8 (21)	8.0 (94)	2.1 (25)	2.1 (25)
Doxycycline	89.8 (1059)	4.0 (47)	1.0 (12)	2.4 (28)	1.4 (16)	1.4 (17)
Analgesics and antipyretics						
Paracetamol	36.2 (427)	36.0 (424)	2.6 (31)	10.9 (128)	2.4 (28)	12.0 (141)
Ibuprofen	72.5 (855)	13.4 (158)	2.2 (26)	3.7 (44)	2.0 (23)	6.2 (73)
Diclofenac	78.5 (926)	9.8 (115)	1.6 (19)	4.0 (47)	1.2 (14)	4.9 (58)
Minerals and vitamins						
Zinc	47.2 (556)	7.5 (89)	6.2 (73)	15.4 (181)	15.8 (186)	8.0 (94)
Magnesium	81.7 (963)	3.4 (40)	2.2 (26)	3.2 (38)	4.0 (47)	5.5 (65)
Iron	73.0 (861)	4.7 (55)	2.6 (31)	2.8 (33)	2.5 (30)	14.3 (169)
Vitamin C	30.6 (361)	12.3 (145)	7.0 (82)	17.6 (208)	20.7 (244)	11.8 (139)
Vitamin B	78.8 (929)	4.0 (47)	2.5 (29)	3.1 (37)	2.9 (34)	8.7 (103)
Vitamin D	47.7 (562)	8.4 (99)	4.2 (50)	11.0 (130)	8.9 (105)	19.8 (233)
Multivitamins	66.4 (783)	5.8 (68)	3.5 (41)	5.1 (60)	6.2 (73)	13.1 (154)
Herbals and supplements						
Propolis	85.6 (1109)	3.8 (45)	2.0 (23)	3.1 (36)	2.5 (30)	3.1 (36)
Omega 3 fatty acid	76.9 (907)	5.1 (60)	2.2 (26)	2.7 (32)	3.6 (43)	9.4 (111)
Immune boosting supplements	80.8 (953)	3.8 (45)	3.1 (37)	4.3 (51)	4.4 (52)	3.5 (41)
Antithrombotic drugs						
Aspirin	77.1 (909)	5.9 (69)	2.8 (33)	4.6 (54)	1.8 (21)	7.9 (93)
Enoxaparin SC (Clexane®)	91.1 (1074)	2.9 (34)	1.8 (21)	2.0 (24)	0.9 (11)	1.3 (15)
Cold and/or cough preparations or mucolytics	63.3 (746)	21.1 (249)	2.0 (23)	5.8 (68)	1.0 (12)	6.9 (81)
Antihistamines	70.7 (834)	13.9 (164)	0.8 (10)	2.7 (32)	0.5 (6)	11.3 (133)
Antiseptic lozenges eg Strepsils®, Halls®, Ricola®	67.1 (791)	17.2 (203)	2.0 (23)	5.2 (61)	1.6 (19)	7.0 (82)

(Continues)

TABLE 2 (Continued)

Drugs	% (n)						
	Never used this medication	To treat symptoms such as fever, muscle pain, and sore throat	I have been in contact with a coronavirus positive person	Because of my positive coronavirus test result	I did not have specific symptoms but used them to prevent coronavirus infection	Consume it regularly for reasons other than COVID-19	
Nasal solutions containing normal saline or sea water	79.6 (939)	8.7 (103)	1.8 (21)	4.0 (47)	0.8 (9)	5.1 (60)	
Clove oil or menthol rub	84.0 (990)	6.4 (75)	1.4 (17)	4.6 (54)	1.5 (18)	2.1 (25)	

TABLE 3 Non-drug items purchased during COVID -19 pandemic (n = 1179)

Have you purchased any of the following items due to COVID-19 pandemic?	% (n)
Thermometer	30.4 (358)
Oximeter	20.9 (246)
Normal saline IV infusion	3.1 (36)
Hand sanitizer	74.0 (872)
I haven't purchased any of the previous items due to the pandemic	16.9 (199)

of false information about the efficacy of many available prescription medications, over-the-counter drugs, as well as vitamins and minerals.²⁵ Fake information about invalid prescriptions were roaming around social media and were disseminated and adapted by the public and even healthcare professionals.²⁶ These include the use of paracetamol, high-doses of vitamin C and D, Zinc, hydroxychloroquine, etc.²⁶ Social media was a source of information about self-medication drugs in about quarter of our participants (24.5%, n = 289).

In our study, we had a high prevalence of self-medication with more than 80% using at least one product to treat or prevent COVID-19. This use was found to be higher in females, married and in the age group of 36-45-year-old, medical field workers, participants who were or have been in a contact with a family member infected with COVID-19. No relationship between education level and tendency to self-medicate was reported in this study. Masnouri et al evaluated the response in a Saudi cohort (n = 388) to governmental mitigation strategies of the pandemic.²⁷ More than third (35%) of them self-medicated for fever and more than 80% were taking immunity boosters. In addition, many used honey (66.5%), ginger (41%), dates (39.9%), black seed (39.9%) and olive oil (35%) for prophylaxis against the viral infection. Respondents with higher educational level and longer working hours were more likely to have positive response. In a pilot study which included 301 adults from Egypt,²⁸ vitamin C and D intake was reported by 27% and 17.7% participants; respectively. Jordan was not an exception, as the increase of using supplements and minerals, had become a trend during the pandemic. In our study, the most commonly used products to self-medicate were vitamin C (57.6%) paracetamol (51.9%), zinc (44.8%) and vitamin D (32.5%).

In spite of the lack of evidence about their efficacy in prophylaxis and/or treatment of COVID-19, a Google Trends analysis showed that the worldwide interest in vitamin D, C and zinc, among other immune-related products, has tremendously increased during the COVID-19 era, especially during the first wave.^{29,30} Media has contributed to promoting the beneficial effects of vitamins on the immune system, especially that the internet is regarded as an easily accessible source to seek information about vitamins and minerals.³⁰

For alleviation of COVID-19 symptoms, paracetamol was the drug mainly used (36.0%) followed by cold and /or cough preparations or

TABLE 4 Factors affecting self-medication practices during COVID-19 pandemic (n = 1179)

Variables	Self-medication		P value*
	Yes % (n)	No % (n)	
Age group (y)			.021
18-25	77.2 (390)	22.8 (115)	
26-35	80.1 (214)	19.9 (53)	
36-45	87.7 (192)	12.3 (27)	
46-55	80.2 (89)	19.8 (22)	
>55	85.1 (57)	14.9 (10)	
Gender			<.005
Male	74.9 (385)	25.1 (129)	
Female	84.7 (563)	15.3 (102)	
Marital status			.001
Married	85.2 (431)	14.8 (75)	
Single	76.3 (480)	23.7 (149)	
Others	84.1 (37)	15.9 (7)	
Educational level			.845
Post graduate	79.7 (126)	20.3 (32)	
University level	81.6 (448)	18.4 (101)	
Diploma	80.6 (162)	19.4 (39)	
12 y	77.9 (134)	22.1 (38)	
Less than 12 y	78.8 (78)	21.2 (21)	
Income (per individual)			.120
750 JD or less	79.1 (605)	20.9 (160)	
More than 750 JD	82.9 (343)	17.1 (71)	
Employment status			.570
Working (full time, part time, has own business)	80.8 (467)	19.2 (111)	
Students	78.3 (224)	21.7 (62)	
Not working, retired or housewife	81.6 (257)	18.4 (58)	
Education in the health or medical field			.061
Yes	83.1 (388)	16.9 (79)	
No	78.7 (560)	21.3 (152)	
Work in the medical field			.010
Yes	86.4 (204)	13.6 (32)	
No	78.9 (744)	21.1 (199)	
If you are working, does your job require your interaction with the public? Eg, banking, education, transportation, healthcare sectors			.333
Yes	81.3 (352)	18.7 (81)	
No	77.5 (107)	22.5 (31)	
How many children (under 18 y of age) live in your household			.276
No children	78.8 (341)	21.2 (92)	
At least one child	81.4 (607)	18.6 (139)	

(Continues)

TABLE 4 (Continued)

Variables	Self-medication		P value*
	Yes % (n)	No % (n)	
How do you assess your health?			.418
Good or very good	80.8 (839)	19.2 (200)	
Moderate or poor	77.9 (109)	22.1 (31)	
Have you been infected with coronavirus?			<.005
Yes	93.4 (383)	6.6 (27)	
No	69.7 (412)	30.3 (179)	
To your knowledge, has any of your close family been infected with coronavirus			<.005
Yes	83.7 (687)	16.3 (134)	
No	72.9 (261)	27.1 (97)	
Where do you live			.855
Amman	81.3 (555)	18.7 (128)	
North of Jordan	79.0 (211)	21.0 (56)	
South of Jordan	80.0 (44)	20.0 (11)	
Middle of Jordan	79.3 (138)	20.7 (36)	

*P values were calculated using Pearson Chi-Square test.

Italic was used to indicate that a P value is below 0.05.

mucolytics, antiseptics lozenges, antihistamines and lastly ibuprofen. This limited use of ibuprofen could be due to the exaggeration of the risk of ibuprofen in social media, which followed a WHO tweet recommending to self-treat with paracetamol instead of ibuprofen.³¹

Interestingly, this study revealed an increased use of antibiotics during the pandemic compared to previous data in 2019, such as azithromycin (21%), compared to 7.8% macrolide use in 2019.³² The main reasons for azithromycin use in this study were either to treat symptoms of upper respiratory tract infections such as fever, muscle pain and sore throat (9.1%, n = 107) or to treat a confirmed case of COVID-19 infection (8%, n = 94).

On the contrary, a study in Peru by Quispe-Cañari et al⁶ revealed that out of the 3792 respondents, the majority (66.6%) did not self-medicate during the pandemic. Among those who self-medicated for COVID-19-related reasons, participants reported self-medications for prevention of the infection, alleviation of symptoms, and treatment of a confirmed case. When these three reasons were combined, it was observed that the drug with the highest self-medication was paracetamol, then azithromycin, ibuprofen, antiretroviral drugs, hydroxychloroquine and penicillins.

When considering reasons behind the use of specific medications, the study in Peru showed that Paracetamol and ibuprofen were mostly used for the alleviation of symptoms like fatigue, fever, muscle pain and sore throat, while paracetamol and azithromycin were mainly used for cough, sneezing, nasal congestion and shortness of breath management.⁶

TABLE 5 Associations between sources of information and use of at least one drug to prevent or treat COVID-19 (n = 1179)

Sources of information	% (n)	% of participants who used this source of information and used at least one drug (n)	% of participants who didn't use this source of information and used at least one drug (n)	P value *
Newspapers	44.0 (519)	75.1 (390)	84.5 (558)	<.005
Physician clinic	27.3 (322)	84.2 (271)	79.0 (667)	.048
TV	14.4 (170)	75.9 (129)	81.2 (819)	.108
Scientific websites like CDC or WHO	25.9 (305)	80.3 (245)	80.4 (703)	.968
Social media	24.5 (289)	77.5 (224)	81.3 (724)	.153
Friends	33.8 (399)	85.0 (339)	78.1 (609)	.005
Pharmacists	43.4 (512)	85.9 (440)	76.2 (508)	<.005
Ministry of health help center	11.5 (136)	86.8 (118)	79.6 (830)	.047
Google search	30.7 (362)	76.8 (278)	82.0 (670)	.038

*P values were calculated using Pearson Chi-Square test.

Italic was used to indicate that a P value is below 0.05.

Out of 1013 Polish respondents,²¹ about half of them indicated that they were involved in an inappropriate self-medication during the lockdown (16.6% took medication for prevention, and 16.8% took prescription without consultation), a behavior that was only observed during the lockdown for some of the time. Predictors of self-medication behaviors were greater religiosity and the presence of children in a household. A study in Togo⁷ showed a lower prevalence than the one observed by our results, but were comparable to the Peru study.⁶ Of 955 participants, the overall prevalence of self-medication to prevent COVID-19 was 34.2%. The most commonly used products were vitamin C (27.6%), and traditional medicine (10.2%). Very few reported the use of chloroquine/hydroxychloroquine (2%). Like our findings, female sex and work in the health sector were significantly correlated to higher probability of self-medication. Furthermore, secondary education and university education level were associated with self-medication in the Togo study, unlike ours. In Uganda, a study was conducted to assess the community's behavioural response to self-medication practice before and during the pandemic.³³ Among 272 respondents, 21.2% practiced self-medication all the time, and more than 50% did it sometimes. Chopra et al, evaluated self-medication practices in upper and middle socioeconomic classes of India amidst the pandemic.³⁴ Out of 1100 respondents, about 25% of them had taken medicine without consultation. They mostly used NSAIDs (36%), antiulcer drugs and antihistamines. Comparable to our findings, females^{33,34} and married participants³⁴ had more likelihood to practice self-medications. These results are in concordance with self-medication practices globally, where females showed a higher prevalence of self-medication in general.³⁵⁻³⁷ Benzodiazepines were used in 14% of Chopra et al study and this was associated with high level of anxiety, but only 4% used anxiolytics in this study. In another study among health workers in Kenya (n = 379),³⁸ the prevalence of self-medication had increased unexpectedly to 60.4%, during the outbreak. The use was higher in females, participants with university level of education, aged 30-41-year-old, single, participants of physical activity, and finally those who experienced drug reaction events. In elderly community of 1141 respondents who

resides in different USA states,²⁰ few made changes in their prescription as well as over-the-counter medications but some started vitamins including zinc (n = 9), vitamin C (6), other supplements,²⁷ and unknown form of homeopathy.²³ Amongst prescription medications, antidepressants and anti-anxiety medications²⁶ were reported as well as aspirin,²³ losartan,²³ and low dose naltrexone.^{20,23} Aspirin use was observed in 15% of our sample, mainly for COVID-19 related purposes. Nasir et al,³⁹ performed a cross-sectional assessment of self-medication patterns of antimicrobials in healthcare workers (n = 655) of Dhaka city in Bangladesh (preprint). Similar to our results, the prevalence of self-medication was very high (~88%). A worrisome finding was that the most frequently used anti-infective drugs during the outbreak in that study were ivermectin, azithromycin, and doxycycline, for the management of COVID-19 symptoms like cough, fever and sore throat, which were taken even without having the COVID-19 PCR testing done (85%).

4.1 | Limitations

The cross-sectional nature of this study hinders us from drawing any causal relationship between self-medication and the pandemic, and inability to capture the future changes in these behaviors after the availability of vaccines, availability of more literature about the nature of treatment and disease, or even changes in pandemic severity. Other limitations that are inherent to surveys include recall bias, survey fatigue (which is a well-documented phenomenon that results when surveyed participants become tired of the survey questions then the quality of the data provided by them begins to deteriorate) and response bias which could limit the conclusions from this survey. In particular, due to the survey distribution methods, a response rate could not be calculated and the selection bias due to convenience sampling is possible. Still, this is the first study in Jordan with a large sample size to describe the prevalence of self-medication patterns during the pandemic, which opens venues for future research about this topic on the national levels.

5 | CONCLUSION

During times of health crises, people might resort to self-medication practices for different reasons such as reducing the prescribing costs,⁴⁰ fear of infection²⁴ and less availability/access to medications.²⁴ The most widely used medication in this study were paracetamol, and other vitamins such as vitamin C, zinc and vitamin D. However, it was alarming that people self-medicated the prescription drugs such as azithromycin and aspirin. If this use is left unmonitored, self-medication can lead to worsening of the patient's health and delay seeking medical advice from healthcare professionals. Efforts should be done to help mitigate risks of self-medications by active involvement of pharmacists and other members of healthcare team to refute false claims about drugs, especially in the media. Patterns of self-medication can be also improved by educating the public about the harmful effects of irrational drug use. Furthermore, strict regulations should be imposed to limit prescribing drugs without prescription in community pharmacies. In order to achieve that, the pharmaceutical care system in Jordan need to be revised to prohibit selling prescription drugs.

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DISCLOSURES

The Authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Eman Elayeh: Idea conception, planning methodology to reach the conclusion, organizing and supervising the course of the project or the article, data collection and /or processing, taking responsibility in logical interpretation and presentation of the results, literature review, taking responsibility in the construction of the whole or body of the manuscript. Amal Akour: Idea conception, planning methodology to reach the conclusion, organizing and supervising the course of the project or the article, data collection and /or processing, literature review, taking responsibility in the construction of the whole or body of the manuscript, critical review of the manuscript. Randa N. Haddadin: Idea conception, planning methodology to reach the conclusion, organizing and supervising the course of the project or the article, data collection and /or processing, literature review, taking responsibility in the construction of the whole or body of the manuscript, critical review of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author, [E.E].

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